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PRELIMINARY FEASIBILITY STUDY FOR EAST CENTRAL WATER CONSERVANCY DISTRICT

PRELIMINARY DRAFT OF CHAPTERS VI, VII AND VIII

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PRELIMINARY DRAFT OF CHAPTERS VI, VII AND VIII

Submitted To:

State of Montana
State Water Resources Board
Helena, Montana 59601

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CHAPTER VI

AREA BENEFITS - DIRECT AND INDIRECT

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AREA BENEFITS - DIRECT AND INDIRECT

A. INTRODUCTION

Benefits derived from a specific water development project may be defined as "positive (beneficial) contributions toward the accomplishment of multiobjectives."[1]

Such benefits may be either direct or indirect in nature and must be measured over time and oriented toward the achievement of stated objectives. In all cases, benefits may not be precisely quantifiable but may, instead require expression in qualitative terms. Expression of benefits in terms of dollars is desirable, unless other quantitative units are considered to be more appropriate.

In the case of the proposed East Central Water Conservancy District the stated objectives are: (1) to affect more efficient use of the available land and water resources and (2) to stimulate and improve the area economy. The benefits which are measured in accordance with the stated objectives must also be compared to the cost of obtaining these benefits. Such a comparison, then, will provide a measure to make judgments as to the feasibility of a given project.

As indicated above such benefits may not always be of

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[1] Source: Standards for Planning Water and Land Resources July 1970, United States Water Resources Council

a direct nature. Not all of the identifiable benefits will be realized within the area in a direct fashion and may not, in fact, be realized for a number of years. Such a stimulating effect on developing areas is in part the result of the multiplier effect which results when new spending, which is initiated, becomes income for others, thus providing new jobs and new opportunities. The overall affect of such activity is far more stimulating and widespread than would be anticipated on the basis of a cursory analysis.

Coal development in the Timber Creek - Weldon area near Circle may be used as an example. If such a development were to become a reality, one of the first implications would consist of additional employment and stimulated area trade. However as time progressed, benefits of a secondary or indirect nature would accrue to not only those directly involved in the original activity but to those in the surrounding communities. Such indirect benefits would, for example, result from increased trade activity in the wholesale, retail and trade sectors contributing toward general growth of those sectors, larger volumes, improved product and service availability, volume, etc. From this example, then, it can be observed that benefits at least in the long term, are a great deal more far-reaching than would be anticipated from casual observation.

It is the objective of this chapter to outline in detail

the benefits which would accrue from water development within the proposed Eastern Montana Water Conservancy District. The benefits which are discussed relate to: (1) potential coal development benefits, (2) agricultural irrigation benefits, (3) municipal water benefits and (4) other very important indirect benefits, particularly those affecting the socio-economic environment of the area.

B. COAL DEVELOPMENT BENEFITS

Anticipated Employment

The employment which would be anticipated as a result of coal development within the proposed Conservancy District area would depend largely upon the type of electrical power generation plant which was ultimately installed. This relative uncertainty is the result of changing technology within the electrical power generation industry. Chapter IV contains more detailed information on material relevant to this coal development question.

If, for example, a generation plant were constructed within the next ten years the plant would more than likely be of the conventional steam power generation type, which would employ from 35 to 45 individuals -- 20 to 25 being employed in the generation plant itself and 15 to 20 within the mining activity. If, however, such a generation plant became a reality sometime after the next ten years, 1980 or later, the general feeling is the plant would be of the gasification,

liquification type (M.H.D.) Such a power generation plant would employ as many as 15,000 of which about 500 would be engaged directly in the mining activity. The remaining employment for the area would be largely professional engineering, administrative and other highly trained technicians. The individual incomes which would be anticipated in large part would be relatively high, particularly in comparison to the area's current average family income as described in Chapter II. A summary of the approximate employment, income and population derived under the two electric power generation systems appears on the following page:

TABLE VI - A

EMPLOYMENT, INCOME AND ESTIMATED POPULATION CHANGES RESULTING FROM INSTALLATION OF AN ELECTRIC POWER GENERATION PLANT IN THE WELDON-TIMBER CREEK AREA OF McCONE COUNTY

	Generation Plant Type	
	Conventional Steam (500 MW)	M.H.D.
Total Employment[1]	35 - 45	15,000
Mining	15 - 20	500
Plant	20 - 25	14,500
Total Income[2]		
Mining	$317,500 - 407,500	$142,000,000
Plant	$127,500 - 170,000	4,250,000
	190,000 - 237,500	137,750,000
Total Population Increase[3]	105 - 135	45,000
Mining	45 - 60	1,500
	60 - 75	43,500

[1] Employment data from Chapter IV.

[2] Income data from Survey of Current Business, July 1970. Assumes average yearly incomes as follows: coal mining - $8,500, coal and petroleum products (engineers, technicians and administration - $9,500. 1970 wage scales are used in all cases.

[3] Population attributable to coal development based upon average size family of three.

Agricultural and Municipal Water Inter-relationships

As indicated in Chapter V, the sale of water for industrial uses such as electric power generation has been considered. Depending upon the type of generation plant which was ultimately installed, the demand in terms of acre feet of water per year could be quite variable. Under the assumption that a conventional steam generation plant of the 500 MW size were developed within the next ten years, the demand in terms of acre feet of water per year would be approximately 7,200 acre-feet. However, if a more expansive M.H.D. plant were constructed beyond the next years, 1980 or later, the requirement in terms of water per year could be approximately 60,000 acre-feet. Needless to say, sale of such water for industrial uses such as power generation is an important, if not crucial consideration to the development of the works considered under the proposed Eastern Montana Water Conservancy District. As indicated in Chapter V, per acre costs even under the conventional steam power generation plant would be substantially reduced by sale of water to such a user. If future technology indicates the feasibility of plants, such as the M.H.D. plant referred to previously, there is little doubt that the acre costs for irrigation of the various plans would be substantially and positively affected. The possibility of water sale to an industrial user most certainly initiates a favorable dimension to be examined in the analysis of proposed works feasibility.

C. IRRIGATION BENEFITS

Introduction

There is little doubt but what a major portion of the direct benefits which would be attributable to water development in the study area would involve direct benefits to agricultural water users. This is certainly not to say that there would not also be very significant direct and indirect benefits associated with water development in the areas of industrial, municipal, and recreational uses of water. The area is now, however, totally dominated by an agricultural economy. In addition, it is certain that this area has a large number of resources which are directly suitable to agricultural production and that even with major industrial development, the area will remain as an important agricultural area. It is, therefore, assumed that the direct benefits from agricultural irrigation would be very significant as a result of increased water development in the area.

Management Assumption Concerning New Irrigated Lands

It is obvious from the material contained and assembled in this study that water development for irrigation purposes would require large sums of investment moneys with the resulting cost of water to the individual farm user being relatively high compared to many other irrigation projects in Montana. It has thus been assumed throughout this study that as additional water resources are developed, it will be a necessity

to employ the very best in terms of management expertise at the farm level to make the most efficient use of the irrigation water made available through the new developments.

There is little doubt that, at the present time, the level of management employed on farms and ranches in Montana and in the study area varies significantly from farm to farm. The method of employing or using basic agricultural resources indeed varies significantly between farms as does the total productivity and return realized from the employment of these agricultural resources.

Interviews with people in the study area, throughout the development of the research, leads one to the conclusion that the people of the area clearly recognize that top-level management is a prerequisite for meaningful water development to take place for irrigation purposes in the study area. This is brought about primarily because of the fact that water developments such as those being considered in the study area are costly and the water will be relatively expensive by the time it is made available on the individual farms and ranches. This demands that the best possible use be made of the water on the individual farms or ranches involved.

A cursory examination of individual farm and ranch situations or an analysis of agricultural statistics clearly reveals that management levels do vary significantly from farm to farm. The assumption made in this study in terms of

all judgements made, as to preliminary feasibility of water development, definitely assumes the employment of top-level management. The study, however, does not attempt to in any way identify a present-day, typical, or average situation. It can basically be assumed that if a typical or average situation prevails, water development projects would become less feasible than under the assumption of top-level management. Meetings and interviews held with individuals within the study area as mentioned previously clearly revealed to the research staff that the necessity of this assumption is clearly recognized within the study area itself.

The Anticipated Use of New Irrigated Acres

It is impossible to talk about the direct benefits of bringing new irrigated acres into production unless one has discussed, at least in part, the likely uses which will be made of this new irrigated land. It is assumed in this analysis that the major portion of new irrigated acres in the study area would initially be used for the growing of crops to directly support increased livestock production within the area. It is also recognized that certain acreages would be used for the production of cash grains and other specialty crops.

The use of the new irrigated acres would tend to vary significantly as certain variables change, which are not necessarily controlled or even affected by actions within

the area, that reflect overall changes in the total agricultural economy of the nation. Thus, in no way is the thesis being advanced that livestock support crops would be the only use, or for that matter even the major long-term use, of new irrigated acres. The assumption is made, however, that a high probability exists that the major portion of new irrigated acres would initially go into the production of crops directly used in the support of livestock. This thesis was strongly supported by interviews with individuals in the study area conducted by the research staff as the study progressed.

New Irrigated Acres and Existing Farm Units

The study and analysis of the location of the potentially irrigable lands within the study area, as presented in Chapter III, clearly shows that they are not heavily concentrated in a few isolated areas. These potentially irrigable lands are scattered throughout the entire study area, and the only large concentration of such lands lies along the Redwater River drainage in the eastern portion of McCone County and the western portions of Dawson and Richland Counties. Even along this drainage the lands are quite scattered in that there are no high concentrations of potentially irrigable land in contiguous areas.

It is thus assumed that the overwhelming majority of newly irrigated lands, as identified within the study area,

would be added to existing farm and ranch units rather than going into or making up new self-contained, irrigated farms. This assumption is also strongly supported by conversations and interviews with local people in the area as to their beliefs concerning the likely use of new irrigated acres.

Again, it is clearly recognized that not all of the new irrigable land would be added to existing units, but it is assumed that most of it would in fact fall into that category of use. Very little of the new irrigated land in this study area would go entirely into new farm units, such as has been the case on many irrigation projects in Montana.

Livestock Feeds and Potentially Irrigable Lands

One basic question that must be asked in an analysis of benefits attributable to irrigation of potentially irrigable lands relates to the identification of the kinds of crops which would likely be raised on the new irrigated lands. This is a very complicated and complex question, especially in light of the fact that this decision will be made primarily by existing, individual farm managers who will be adding irrigated acres to their already existing resource base.

The factors that will be most instrumental in determining how the new irrigated lands are used are factors which are peculiar to the individual farm or ranch situations or resources to which the irrigated land base would be added.

The two most critical factors which would determine how new irrigated lands would be used on an individual farm or ranch situation are linked directly to: (1) the management employed on that farm or ranch and (2) the identification of the total resources which are available for use in an individual farm or ranch situation.

One example is that a particular farm or ranch may have a set of resources which obviously results in a situation where the ranch has a deficient supply of winter feed. This may result simply because the present resources do not allow for the production of sufficient winter feed to balance with other resources available during other periods of the year.

Yet a second individual ranch situation might have an excess capacity of fall and winter feed production, while at the same time experiencing a critical shortage of summer feed. Examples of this are relatively easy to find within the study area because of the large acreages of small grains produced. These small grains produce or result in some production of fall and winter feed in the form of straw as a by-product of the grain production, as well as animal unit months (AUM's) of fall grazing on acreages of harvested grain crops and range lands which are intermittent with these acreages of cash grains. In this second ranch situation, the most efficient use of the new irrigated acres would likely dictate a much different use than in the first

situation discussed.

Yet a third possibility would be to have a farm-ranch combination with an abundance of low-quality winter feed roughage in the form of straw with no adequate way of using this straw because of not having available the kinds of feeds which can be fed in combination with the straw in wintering livestock. This unit would likely use the potentially irrigable acres in yet another fashion.

The point being made in the above paragraphs is simply that the individual farm or ranch situation will ultimately dictate the use of the new irrigated acres. This is not, however, the case if you examine an irrigation project where the assumption is made that new, self-contained irrigated farms will come into existance as a result of that project. No attempt made in this study to identify the exact use to which newly irrigated acreages will be put, other than to specify that they will be added to existing units. In addition, they will likely go into the production of feeds to directly support livestock. No attempt is made in this preliminary study to estimate the proportion that would go into any one of these livestock supporting feeds.

The sections which follow describe four possible uses of newly irrigated land. Specific crops are used only to indicate the expected productivity of these crops on the new irrigated acres in the area, assuming top-level management in the employment of all resources relative to these new

irrigated lands. The crops that will be discussed are: (1) winter feed in the form of high quality hay, (2) improved irrigated pasture which is intensively managed, (3) corn and other silage, and (4) small grains to be used in the area as livestock concentrates.

The Measurement of Benefits from Crops Grown on New Irrigated Acres

It is possible to outline, for any specific crop, an expected cost of production and compare that to its expected gross return. As a result, one can then arrive at a net, gross return as a result of producing this crop. In other words, it is possible to outline for a particular crop a series of management practices associated with the growing of that crop and directly compare that to the yield and price associated with the output.

Such an example is found in Table VI-B for one particular crop--namely, alfalfa hay. The material found in that table is based or taken directly from material published in the Bulletin 1069 of the Montana Cooperative Extension Service. This data shows estimated annual stand establishment costs of $8.50 per acre per year for alfalfa hay, which is estimated as the share, on a per year basis, which should be attributed to an acre of alfalfa hay for the re-establishment of that crop on a regular basis. In addition, there are other direct operating costs of $6.45 per acre, excluding harvesting. The table also shows direct harvesting costs of $23.44 per

acre which assumes three crops of hay harvested per year. This results in a sub-total of $38.39 in direct operating costs with total direct cost of the production of an acre of alfalfa being $48.91 when other overhead and management cost are included. This does not allow for any cost directly associated with the land or irrigattion water itself. Land costs in this instance were estimated at $34.29 making a total cost of $83.20.

Many precautions are found in the forward of this publication which caution the reader in the use of the contained data for any purpose other than as a guideline to an average situation, given very specific assumptions concerning farm organization and size. These precautions are well taken because it is easy to abuse this type of data, even though it is very useful for its designed purposes.

It is possible to compare this cost data, for example, to a yield of alfalfa hay of (x) tons per acre at a value of (y) dollars per ton available on the farm or ranch. This means that the gross return from the production of a four ton crop, valued at $25.00 per ton (of alfalfa hay) would be approximately $100, with an annual operating cost of $48.91, giving a gross return of $51.09 to cover all land and water costs plus return to the operation in question. If the land costs are separated out, this leaves a return of $16.80 to cover direct water costs plus a dollar return to the operation. This is one way to approach the question as to the benefit

which would be attributable to the increased production of alfalfa hay as a result of the new irrigable land becoming available for that use in the study area. This is, however, a type of analysis which is extremely dangerous unless one knows the individual farm or ranch situation on which the new lands are made available for the production of irrigated alfalfa hay. This kind of an analysis is not employed in this study for a number of reasons.

First, the yield assumption of four tons of irrigated alfalfa per acre between farms and ranches. There are many farms and ranches within Montana, in established irrigated areas, where the yields of alfalfa hay on irrigated lands are from two to three tons per acre. It is obvious that two to three tons per acre can, however, be achieved in individual situations with considerably less cost than is included in the example described above, because the handling costs are certainly less with less tonnage to handle and many irrigated hay acres are handled in a way that would result in the kinds of costs reflected above.

In addition, there are also considerable variations in individual cost items as reflected in detailed studies of individual farms or ranches as is pointed out in the bulletin itself.

It is entirely possible that on some farms and ranches the costs of handling in terms of hay crop may vary considerably because of the management and associated factors relevant

to tha handling of that hay crop. One example is that it is obvious that the handling costs decrease as the tonnage per acre produced increases. It is also certain that the relevant question to ask in terms of an individual farm situation is not the question as outlined above, but rather, what does the result look like as one adds new irrigated acres in the production of alfalfa hay to an existing ranch situation, and this can never be answered by the kind of analysis employed above.

Discussions with agricultural leaders in the study area resulted in assumptions that, under top-level management conditions and adequate supplies of irrigation water throughout the production year, 6 to 8 ton alfalfa hay yields could be obtained. This of course, again, is assuming a maximum utilization of resources and a full employment of agricultural technology available to individual operators.

Thus, the approach to benefits which could be derived by the growing of individual crops within the study area is discussed in non-monetary terms in this preliminary feasibility study, clearly recognizing that these benefits on an individual farm or ranch situation can be identified if, and only if, one makes very specific assumptions as to the use of that new irrigated acre in that given individual farm or ranch situation.

Problems with livestock supporting crops such as corn silage and irrigated pasture are even more difficult to deal with in the fashion described above. The problem of pricing

the AUM's of grazing produced or the tons of corn silage produced further complicates matters, because these crops do not have well established market prices. One could assume a price of $3.50 or $4.00 per AUM of grazing on irrigated pasture, but this is, at best, only a guess because there is not a well established market for such grazing practices, other than just the number of AUM's supplied.

TABLE VI-B

ALFALFA HAY - COSTS PER ACRE*

Operation	Total Cost per Acre
Cleaning ditch	.70
Weavil control, custom	4.00
Irrigate	1.75
Mowing	5.42
Raking	5.72
Baling	7.96
Twine	1.82
Hauling & stacking labor	.70
Truck and loader	1.32
Annual cost of stand establishment	8.50
Subtotals	38.39
Interest on operating capital	.60
Miscellaneous overhead, 5% of subtotal	1.92
Management, 10% of 4 tons @$20	8.00
	48.91

REAL ESTATE COSTS PER ACRE

Item	Total Cost per Acre
Land	28.38
Building & improvements	5.91
Subtotals	34.29
Total Cost Per Acre	83.20

* Source: Enterprise Costs of Irrigated Crops in South Central Montana, Cooperative Extension Service, Bulletin 1069, November, 1969, Montana State University, Bozeman.

Irrigated Pasture Benefits

It is very probable that a portion of the new irrigated acres would go into the production of irrigated pasture to be used as a summer feed for livestock. This provides several kinds of very significant benefits to individual farm and ranch operations.

The first and most obvious is that the new irrigated acre would provide a significantly larger number of AUM's of feed than if the land was used as a dry crop acre or an acre in dryland range. It would be assumed that under top management, 10 to 15 AUM's of grazing per season per acre could be obtained by carefully managed irrigated pasture.

In addition to this, increased carrying capacity of the ranch acreages of irrigated pasture would allow for a considerably different use of dryland range than is now common on most ranches in the study area. Much of the dryland range in the study area is now being utilized during the early spring and summer periods when the range crops are in their growth process and struggling to maintain themselves on the range. It is considered very beneficial to the dryland range resources if grazing can be deferred entirely or made very light during the early spring and mid-summer periods to allow for a steady, undisturbed growth of the native range lands. Such practices are highly recommended to improve native range and increase carrying capacity of this range. However, such practices are in most instances now very costly, and in some cases,

totally impractical because of the conditions under which the typical ranch operates. However, if one had large acreages of irrigated pasture to use during this period, it would be possible to defer use of the dryland range resources during the early spring and mid-summer periods and use irrigated pasture in its place. This would allow one to more fully utilize the feed produced on the range by deferring its use to periods during the late summer, fall, and winter periods; at which time the range plants are dormant in terms of major growth activity. This late fall and early winter use of dryland range would also, in some instances, result in improved ability to substitute relatively inexpensive AUM's of winter grazing on the deferred range for AUM's now being supplied relatively more expensively, in winter hay or silage feeding programs.

Thus, it is again quite obvious that in this type of situation, one acre of irrigated pasture would result in a benefit to the individual farm or ranch situation of significantly more than just the equivalent "market value" of 10 to 15 AUM's of feed produced; but in addition, provision would be made for better utilization of all resources, while at the same time improving the existing dryland range resources.

Alfalfa Hay and Corn Silage

Certain farm and ranch units within the study area are now either limited severely in terms of their ability to produce winter feeds or are forced to produce this winter feed

in a very inefficient manner. In many cases within the study area, the winter feed is now being produced by harvesting hay or silage of relatively low yield over a large number of acres. These hay acreages are, many times, either in dryland hay or in valleys where wild hay is harvested because water spreading occurs in these valleys.

In addition, there exists a number of acres of both domestic and wild hay where minimum irrigation has been employed by the development of on-farm resources or water spreading systems which distribute water onto these lands to increase hay production.

The addition of new irrigated acres on such farm units would allow for a much more concentrated production of the winter feed on a smaller number of acres, and at the same time, free existing acres for other uses such as grazing. Many acreages now used for the production of wild hay would be very desirable for use with other native range resources.

This concentration of the hay production on fewer acres tends to reduce the time and certainly the cost of producing hay on the individual farm units and also concentrates hay production into fewer land resources.

This increased ability to produce on-farm winter feed in the form of high-quality hay or silage would also in many instances, make it more feasible for an individual farm or ranch operation to more adequately use the straw which is produced as a by-product of cash grains grown on dryland crop

acres on the farm or ranch. There is definitely a considerable amount of straw available for winter feed as a relatively cheap roughage in the area at the present time which is not being fully utilized. Part of the reason for this poor utilization of low-quality roughage is undoubtedly tied to the lack of other on-farm feeds of high enough quality which can be produced at prices or costs which will make them available to feed in combination with straw. An example would be that producing large quantities of high-quality alfalfa hay or corn silage at reasonable costs could provide for an opportunity to more effectively utilize the low-quality roughage such as wheat and barley straw which are now by-products of cash crops grown in the area on certain farms.

Under top-level management it is estimated that 20-28 tons of corn silage, and 5 to 7 tons of alfalfa could be realized on new irrigated acres used in the production of these crops for winter feed production opens up many new alternatives in the management and use of resources available on individual farms or ranches of the area.

Cash Grains and Other Crops Grown as Concentrates for Live-Stock Production

Certain irrigated acres made available to individual farms or ranches will be used for the production of concentrate feeds in the form of silage or grains to be used in the feeding of livestock. This will allow for individual farm-ranch situations to produce some of their own home-grown supplement feeds for not only the wintering of breeding stock, but

also the wintering and/or fattening of calves produced on the farm. These concentrate feeds could be used in a variety of ways. The precise usage would depend entirely upon the individual situation existing in terms of resources available to the farm or ranch.

It is entirely conceivable that large numbers of calves which are currently sold from the farms in the area, could be held over and sold as yearlings or as fattened animals. This is one likely result of making increased irrigated lands available to the area. Throughout the development of this study it has become obvious that there is considerable interest in additional cattle feeding within the study area. If this desire becomes a reality, significant acreages of feed grains could be produced on new irrigated lands to directly support such livestock feeding operations.

It should again, however, be pointed out that even without livestock feeding, some acreages of concentrate feeds will likely be grown to support breeding herds and other livestock produced on the farm.

Other Direct Benefits from New Irrigated Acres

It has been clearly stated above that new irrigated acres could result in many direct benefits to individual farmers and ranchers in the form of summer feed, winter feed, and/or concentrate feeds produced on farms as a result of making water available to the lands in the area. There would also, however, be significant additional benefits of a direct nature as a

result of this irrigation activity and new irrigated lands, not only within the farm unit but also in the area. Increased agricultural employment would undoubtedly result on the individual farms and ranches as well as a significant increase in total income and resource use flexibility upon individual farms and ranches.

There would also be a significant increase in the tax base, including the value of agricultural properties, as a result of the introduction of acreages of new irrigated lands into the area. There would also be increased stabilization of the agricultural economy, which would result in many other indirect benefits affecting the area's socio-economic environment.

These indirect benefits are discussed in some detail in Section E, as they relate to not only agricultural development, but also water development for industrial, municipal and recreational purposes.

Potentially Irrigable Lands of the Study Area

The identification of potentially irrigable lands and the detailed quantities of such lands are found in Chapter III of this report. In Chapter III there is a series of enumerative data tables which contain material relevant to: (1) total crop land by township, (2) total potentially irrigable land by township, (3) potentially irrigable land by class and (4) the acres of range and crop land which would be replaced

by the potentially irrigable lands identified. It is pointed out in Chapter III that all of these potentially irrigable lands are certainly not within reach of the proposed works which are outlined and discussed in detail in Chapter V. These lands were classified as potentially irrigable lands without any consideration being given to the feasibility of securing irrigation water for the lands in question.

Chapter V contains detailed engineering data as to the acreages and locations of these potentially irrigable lands which could be reached by each of the six alternate irrigation systems considered. Following in this chapter is a set of tables which summarize all of the material presented, as to potentially irrigable lands in Chapter III, as well as information concerning the lands which would be reached under each of the alternate irrigation systems.

Tables VI-C, VI-D, and VI-E summarize all of the material presented in Chapter III as to potentially irrigable lands in each of the 28 sub-areas of the study area. The detailed tables for each sub-area, as well as maps showing location of those potentially irrigated lands, are found in Chapter III. Figure VI-1 is a map showing the 28 sub-areas which have been used as a presentation breakdown throughout the entire study.

Table VI-C shows that there are total potentially irrigable lands in Garfield County of 50,946 acres. Of this 50,946 acres, Table VI-C indicates that 34,826 acres of the land is classified as Class III and 16,120 as Class II. In addition, it is also shown in Table VI-C that nearly 75 percent or approximately 38,000 acres of the potentially irrigable land area are now in range land with the other 25 percent or 13,000 acres presently being used as cropland. Approximately 32 percent of potentially

TABLE VI-C

POTENTIALLY IRRIGATED LAND IN
GARFIELD COUNTY BY STUDY SUB AREA

Study Sub area	Potentially Irrigable Land (Acres) Present Use: Cropland - italics Rangeland - italics		
	Class II	Class III	Total
G-1	-	-	-
G-2	-	-	-
G-3	-	-	-
G-4	1275	395	1670
	238	*92*	*330*
	1037	*303*	*1340*
G-5	214	2413	2627
	-	*40*	*40*
	214	*2373*	*2587*
G-6	3875	8566	12441
	1864	*2323*	*4187*
	2011	*6243*	*8254*
G-7	4438	8133	12571
	919	*1337*	*2256*
	3519	*6796*	*10315*
G-8	221	1350	1571
	120	*198*	*318*
	101	*1152*	*1253*
G-9	1344	1958	3302
	125	*499*	*624*
	1219	*1459*	*2678*
G-10	1341	1354	2695
	366	*219*	*585*
	975	*1135*	*2110*
G-11	2194	3407	5601
	1113	*1228*	*2341*
	1081	*2179*	*3260*

(continued on following page)

	Class II	Class III	Total
G-12	312	2092	2404
	23	*245*	*268*
	289	*1847*	*2136*
G-13	687	686	1373
	-	-	-
	687	*686*	*1373*
G-14	219	4472	4691
	147	*1885*	*2032*
	72	*2587*	*2659*
GARFIELD TOTALS			
	16,120	34,826	50,946
	4,915	*8,066*	*12,981*
	11,205	*26,760*	*37,965*
Percent by Class	31.64	68.36	100
Percent Cropland	*30.49*	*23.16*	*25.48*
Percent Rangeland	*69.51*	*76.84*	*74.52*

TABLE VI-D

POTENTIALLY IRRIGATED LAND IN
MCCONE COUNTY BY STUDY SUB AREA

Study Sub area	Potentially Irrigable Land (Acres) Present Use: Cropland - italics Rangeland - italics		
	Class II	Class III	Total
M-1	5383	4990	10,373
	3518	*1557*	*5,075*
	1865	*3433*	*5,298*
M-2	4595	28918	33,513
	2513	*20002*	*22,515*
	2082	*8916*	*10,998*
M-3	1152	2162	3,314
	486	*1038*	*1,524*
	666	*1124*	*1,790*
M-4	1021	11440	12,461
	423	*8338*	*8,761*
	598	*3102*	*3,700*
M-5	2724	2196	4,920
	2067	*1363*	*3,430*
	657	*833*	*1,490*
M-6	717	3281	3,998
	572	*1893*	*2,465*
	145	*1388*	*1,533*
M-7	1428	1264	2,692
	465	*545*	*1,010*
	963	*719*	*1,682*
M-8	2076	5755	7,831
	1118	*3105*	*4,223*
	958	*2650*	*3,608*
M-9	3258	6604	9,862
	2215	*4513*	*6,728*
	1043	*2091*	*3,134*

(continued on following page)

	Class II	Class III	Total
M-10	4572	4132	8,704
	2492	*2601*	*5,093*
	2080	*1531*	*3,611*
McCone TOTALS	26926	70742	97,668
	15869	*44955*	*60,824*
	11057	*25787*	*36,844*
Percent by Class	27.57	72.43	100
Percent Cropland	*58.94*	*63.55*	*62.28*
Percent Rangeland	*41.06*	*36.45*	*37.72*

TABLE VI-E

POTENTIALLY IRRIGATED LAND IN
DAWSON AND RICHLAND COUNTIES BY STUDY SUB-AREA

Study Sub-area	Potentially Irrigable Land (Acres) Present Use: Cropland - italics Rangeland - italics		
	Class II	Class III	Total
DR-1	-	1213	1213
		1148	*1148*
		65	*65*
DR-2	1642	7036	8678
	936	*5397*	*6333*
	706	*1639*	*2345*
DR-3	17069	36419	53488
	7534	*23338*	*30872*
	9535	*13081*	*22616*
DR-4	3272	16133	19405
	1363	*748 1*	*8844*
	1909	*8652*	*10561*
DAWSON, RICHLAND TOTALS	21983	60801	82784
	9833	*37364*	*47197*
	12150	*23437*	*35587*
Percent by Class	26.55	73.45	100
Percent Cropland	*44.73*	*61.45*	*57.01*
Percent Rangeland	*55.27*	*38.55*	*42.99*

irrigated land is classified as Class II.

Table VI-D shows that there are 97,668 acres of potentially irrigable land identified in McCone County. This 97,668 acres of potentially irrigable land includes 26,926 acres in Class II and 70,742 acres in Class III. The present use of the potentially irrigable lands in McCone County includes approximately 62 percent which is now crop with 37 percent presently in range.

The data in Table VI-E shows that the areas of potentially irrigated land in Dawson and Richland Counties, which are included in this study, account for 82,784 acres. The majority of these acres, or 57 percent, are now in cropland with 43 percent in rangeland. The potentially irrigable land in Dawson and Richland Counties is broken down between classes as follows: Class II - 27 percent; Class III - 73 percent.

A quick review of Tables VI-C, VI-D, and VI-E, which is a summary of material presented in Chapter III, clearly reveals that there is a large number of acres of potentially irrigable lands scattered throughout the study area. Exact locations of these lands are, of course, identified in detail in Chapter III. There would, indeed, be a tremendous benefit derived by the individual farms within the study area, as well as to the economy of the entire proposed conservancy district area, should these potentially irrigable lands be changed from their present

use and developed as irrigable lands.

Gross Return Variances Between Rangeland or Dry Cropland and Fully Developed Irrigated Acres

An acre of land, which is presently in the production of native range, can generally be assumed to yield approximately one-half animal unit month of grazing per year. This does indeed vary somewhat, depending upon the quality of the rangeland acre in question. Generally, however, one-quarter to three-quarters of an AUM per acre is the production which can be expected annually from an acre of rangeland. Assuming a value per AUM of grazing of $4.50 per acre, this indicates that the annual gross return from an acre of rangeland varies from a low of under $2.00 per acre to a high of slightly more than $3.00 per acre. Thus, the logical conclusion is that the expected gross return from one acre of rangeland is presently expected to be between $2.00 to $3.00 per acre.

Substantial acreages of the cropland in the study area are presently used in the production of cash grains, primarily in the form of wheat. It is also reasonable to assume that most of this dryland cash grain farming centers around a crop harvested every two years, with summer fallow on that acreage in the alternate year. The expected wheat yield from an acre of cropland in the study area can generally be assumed to be between 25 to 35 bushels. If one then assumes that $1.50 per bushel is the

expected price for wheat, it can be concluded that the gross return per harvested acre of cropland would be between $37.50 and $52.50. It is then necessary to divide this return in half to account for the fact that an acre is expected to be harvested every other year--yielding an expected annual gross return from cropland of approximately $19 to $26 per acre.

Under the assumptions which have been described in the above two paragraphs and earlier sections of this Chapter, it is clear that the addition of irrigable acres to existing farm units can be expected to contribute more in terms of gross benefit to that farm unit than just the value of the crop produced on that individual acre. This has been established on the basis that the relevant consideration to be examined in relationship to total benefits is not only the cash return per individual acre added, but rather the cash return received plus the overall contribution that the addition of the potentially irrigable acre makes to the total farming operation and total resource use.

It is possible, however, to in a rough way, indicate the expected gross return or production which would be attributed to new irrigable acres used in the production of various crops.

For this analysis it is assumed that an irrigated acre of alfalfa hay would be expected to produce from

four to six tons of hay per acre, with hay valued at $25 per ton. This would account for an annual expected gross return of $100 to $150 per acre.

The expected gross return from irrigated pasture would be $45 to $75 per acre per year. This return is based on the assumption of 10 to 15 AUM's of production per year valued at $4.50 per AUM.

Irrigated barley is assumed to yield 70 to 100 bushels per acre with barley valued at $.85 per bushel. This yields a gross return of $60 to $85 per acre per year.

A crop of corn silage yielding 20 to 25 tons would produce an annual crop return of $140 to $175. This assumes a price per ton of corn silage at $7.

From the discussion above, it is obvious that when an acre of dry cropland is replaced by a fully developed acre of irrigated land, the expected gross return from the new developed irrigated acre could logically be expected to increase from three to eight times its original return as dry cropland. This simply means that when one replaces an acre of dry cropland with an acre of fully developed irrigated land, that the gross income affect to the area and to the farm in question, is tremendous. This does not, however, tell the entire story in that the addition of this irrigated acre may likely make a much larger contribution to the individual farm or ranch than just the estimated cash return in production

from that acre, because of better enabling total resource planning as discussed previously in this chapter.

The multiplying effects are much greater, however, when one considers replacing an acre of rangeland with an acre of fully developed irrigated land. In this instance, the increase in gross income or return would be 40 to 60 times that experienced from dryland range.

It is completely obvious from the above discussion that the development of potentially irrigable lands within the study area would have very significant direct income affects, not only for the individual farms involved, but for the entire study area. It is also obvious from Chapter III that large acreages of potentially irrigable land are available for such water development.

Potentially Irrigable Lands Reached By Each Alternate Irrigation System Analyzed

Chapter V considers six alternate irrigation systems; four of which are in Garfield County and two of which are in the area of McCone, Dawson and Richland Counties.

The following series of tables (Tables VI-F, VI-G, VI-H, VI-I, VI-J, and VI-K) summarize the data for each of these plans, as to the total potentially irrigable land which could be developed under each plan. This data is presented in the tables by township and includes the following information: (1) the total potentially irrigable land by class and in total for each township under

TABLE VI-F
GARFIELD PLAN A

POTENTIALLY IRRIGATED LAND (ACRES)

Legal Description	Present Use: Cropland - italics Rangeland - italics		
	Class II	Class III	Total
T17N - R35E	299	64	363
	11	*35*	*46*
	288	*29*	*317*
T18N - R35E	222	810	1,032
	140	*237*	*377*
	82	*573*	*655*
T18N - R36E	40	901	941
	-	*156*	*156*
	40	*745*	*785*
T19N - R35E	915	1,149	2,064
	498	*615*	*1,113*
	417	*534*	*951*
T20N - R35E	363	23	386
	293	*2*	*295*
	70	*21*	*91*
T18N - R37E	837	-	837
	53	-	*53*
	784	*784*	*784*
T18N - R38E	11	717	728
	-	*57*	*57*
	11	*660*	*671*
T18N - R39E	-	850	850
	-	*102*	*102*
	-	*748*	*748*
T18N - R40E	555	378	933
	247	*96*	*343*
	308	*282*	*590*
T18N - R41E	144	466	610
	23	*42*	*65*
	121	*424*	*545*

(continued cn following page)

T18N - R42E	-	200	200
	-	*10*	*10*
	-	*190*	*190*
T19N R36E	613	1,290	1,903
	485	*245*	*730*
	128	*1,045*	*1,173*
T19N- R42E	-	2,477	2,477
	-	*739*	*739*
	-	*1,738*	*1,738*
T20N - R42E	-	707	707
	-	*20*	*20*
	-	*687*	*687*
T19N - R39E	491	498	989
	204	*59*	*263*
	287	*439*	*726*
T19N - R40E	277	200	477
	5	*57*	*62*
	272	*143*	*415*
T20N - R39E	874	-	874
	216	-	*216*
	658	-	*658*
T19N - R38E	37	464	501
	11	*144*	*155*
	26	*320*	*346*
T19N - R37E	147	800	947
	92	*392*	*484*
	55	*408*	*463*
T20N - R36E	152	178	330
	132	*66*	*198*
	20	*112*	*132*
T20N - R40E	616	43	659
	25	-	*25*
	591	*43*	*634*
T20N - R41E	1,086	712	1,798
	195	*60*	*255*
	891	*652*	*1,543*

(continued on following page)

T21N - R40E	540	210	750
	210	-	*210*
	330	*210*	*540*
TOTALS	8,219	13,137	21,356
	2,840	*3,134*	*5,974*
	5,379	*10,003*	*15,382*
Percent by Class	38.49	61.51	100
Percent Cropland	*35.55*	*23.86*	*27.97*
Percent Rangeland	*65.45*	*76.14*	*72.03*

TABLE VI-G
GARFIELD PLAN B

PRESENTLY IRRIGATED LAND (ACRES)

Legal Description	Present Use: Class II	Cropland - italics Rangeland - italics Class III	Total
T19N - R39E	45	45	90
	19	*5*	*24*
	26	*40*	*66*
T20N - R39E	150	-	150
	38	-	*38*
	112	-	*112*
T21N - R39E	667	143	810
	2	*80*	*82*
	665	*63*	*728*
T18N - R40E	555	378	933
	247	*96*	*343*
	308	*282*	*590*
T19N -R40E	277	200	477
	5	*57*	*62*
	272	*143*	*415*
T20N - R40E	616	43	659
	25	-	*25*
	591	*43*	*634*
T21N - R40E	608	238	846
	236	-	*236*
	372	*238*	*610*
T18N - R41E	144	466	610
	23	*42*	*65*
	121	*424*	*545*
T20N - R40E	1,086	712	1,798
	195	*60*	*255*
	891	*652*	*1,543*

(continued on following page)

T18N - R42E	-	200	200
	-	*10*	*10*
	-	*190*	*190*
T19N - R42E	-	2,477	2,477
	-	*739*	*739*
	-	*1,738*	*1,738*
T20N - R42E	-	707	707
	-	*20*	*20*
	-	*687*	*687*
TOTALS	4,148	5,609	9,757
	790	*1,109*	*1,899*
	3,358	*4,500*	*7,858*
Percent by Class	42.51	57.49	100
Percent Cropland	*19.05*	*19.77*	*19.46*
Percent Rangeland	*80.95*	*80.23*	*80.54*

TABLE VI-H

GARFIELD PLAN C

POTENTIALLY IRRIGATED LAND (ACRES)

Legal Description	Present Use: Cropland - italics Rangeland - italics		
	Class II	Class III	Total
T17N - R35E	299	64	363
	11	*35*	*46*
	288	*29*	*317*
T18N - R35E	222	810	1032
	140	*237*	*377*
	82	*573*	*655*
T18N - R36E	40	901	941
	-	*156*	*156*
	40	*745*	*785*
T19N - R35E	915	1149	2064
	498	*615*	*1113*
	417	*534*	*951*
T20N - R35E	363	23	386
	293	*2*	*295*
	70	*21*	*91*
T18N - R37E	837	-	837
	53	-	*53*
	784	-	*784*
T18N - R38E	11	717	728
	-	*57*	*57*
	11	*660*	*671*
T18N - R39E	-	850	850
	-	*102*	*102*
	-	*748*	*748*

(continued on following page)

	Class II	Class III	Total
T18N - R40E	555	378	933
	247	*96*	*343*
	308	*282*	*590*
T18N - R41E	144	466	610
	23	*42*	*65*
	121	*424*	*545*
T18N - R42E	-	200	200
	-	*10*	*10*
	-	*190*	*190*
T19N - R36E	613	1290	1903
	485	*245*	*730*
	128	*1045*	*1173*
T19N - R42E	-	2477	2477
	-	*739*	*739*
	-	*1738*	*1738*
T20N - R42E	-	707	707
	-	*20*	*20*
	-	*687*	*687*
T19N - R39E	491	498	989
	204	*59*	*263*
	287	*439*	*726*
T19N - R40E	277	200	477
	5	*57*	*62*
	272	*143*	*415*
T20N - R39E	370	-	370
	93	-	*93*
	277	-	*277*
T19N - R30E	37	464	501
	11	*144*	*155*
	26	*320*	*346*
T19N - R37E	147	800	947
	92	*392*	*484*
	55	*408*	*463*

(continued on following page)

	Class II	Class III	Total
T20N - R36E	152	178	330
	132	*66*	*198*
	20	*112*	*132*
TOTALS	5,473	12,172	17,645
	2,287	*3,074*	*5,361*
	3,186	*9,098*	*12,284*
Percent by Class	31.02	68.98	100
Percent Cropland	*41.79*	*25.25*	*30.38*
Percent Rangeland	*58.21*	*74.75*	*69.62*

TABLE VI-I

GARFIELD PLAN D

PRESENT LAND USE & POTENTIALLY IRRIGATED LAND

Potentially Irrigable Land (Acres)

Legal Description	Present Use: Cropland - italics Rangeland - italics Class II	Class III	Total
T19N - R42E	-	2477	2477
	-	*739*	*739*
	-	*1738*	*1738*
T20N - R42E	-	707	707
	-	*20*	*20*
	-	*687*	*687*
T20N - R41E	828	552	1380
	149	*44*	*193*
	679	*508*	*1187*
TOTALS	828	3736	4564
	149	*803*	*952*
	679	*2933*	*3612*
Percent by Class	18.14	81.86	100
Percent Cropland	*18.0*	*21.49*	*20.86*
Percent Rangeland	*82.0*	*78.51*	*79.14*

TABLE VI-J

McCONE PLAN A

PRESENT LAND USE & POTENTIALLY IRRIGATED LAND

Legal Description	Potentially Irrigable Land (Acres) Present Use: Cropland - italics Rangeland - italics		
	Class II	Class III	Total
T21N - R44E	-	400	400
	-	*112*	*112*
	-	*288*	*288*
T21N - R45E	182	1,218	1,400
	141	*937*	*1,078*
	41	*281*	*322*
T22N - R45E	1,440	60	1,500
	1,151	*49*	*1,200*
	289	*11*	*300*
T25N - R45E	-	800	800
	-	*328*	*328*
	-	*472*	*472*
T20N - R46E	246	354	600
	170	*190*	*360*
	76	*164*	*240*
T21N - R46E	102	98	200
	59	*35*	*94*
	43	*63*	*106*
T22N - R46E	225	75	300
	146	*37*	*183*
	79	*38*	*117*
T23N - R46E	204	196	400
	107	*117*	*224*
	97	*79*	*176*

(continued on following page)

	Class II	Class III	Total
T24N - R46E	48	203	251
	12	*174*	*186*
	36	*29*	*65*
T20N - R47E	654	57	711
	244	*19*	*263*
	410	*38*	*448*
T22N - R47E	398	576	974
	358	*437*	*795*
	40	*139*	*179*
T19N - R48E	270	1,230	1,500
	174	*681*	*855*
	96	*549*	*645*
T20N - R48E	153	747	900
	85	*500*	*585*
	68	*247*	*315*
T21N - R48E	-	500	500
	-	*310*	*310*
	-	*190*	*190*
T22N - R48E	-	500	500
	-	*180*	*180*
	-	*320*	*320*
T20N - R49E	-	500	500
	-	*165*	*165*
	-	*335*	*335*
T22N - R49E	-	700	700
	-	*448*	*448*
	-	*252*	*252*
T24N - R50E	275	2,225	2,500
	74	*1,626*	*1,700*
	201	*599*	*800*
T25N - R50E	-	2,464	2,464
	-	*1,552*	*1,552*
	-	*912*	*912*
T26N - R50E	150	2,350	2,500
	24	*1,826*	*1,850*
	126	*524*	*650*

(continued on following page)

	Class II	Class III	Total
T27N - R50E	370	130	500
	185	*80*	*265*
	185	*50*	*235*
T20N - R50E	88	312	400
	30	*98*	*128*
	58	*214*	*272*
T21N - R50E	2700	2300	5000
	1029	*1521*	*2550*
	1671	*779*	*2450*
T22N - R50E	2450	4550	7000
	253	*1567*	*1820*
	2197	*2983*	*5180*
T23N - R50E	1118	3182	4300
	512	*2670*	*3182*
	606	*512*	*1118*
TOTALS	11,073	25,727	36,800
	4,754	*15,659*	*20,413*
	6,319	*10,068*	*16,387*
Percent by Class	30.09	69.91	100
Percent Cropland	*42.93*	*60.87*	*55.47*
Percent Rangeland	*57.07*	*39.13*	*44.53*

TABLE VI - K
McCONE PLAN B

PRESENT LAND USE & POTENTIALLY IRRIGATED LAND

Legal Description	Present Use:	Potentially Irrigable Land (Acres) Cropland - italics Rangeland - italics	
	Class II	Class III	Total
T21N - R44E	-	400	400
	-	*112*	*112*
	-	*288*	*288*
T21N - R45E	182	1218	1400
	141	*937*	*1078*
	41	*281*	*322*
T22N - R45E	1440	60	1500
	1151	*49*	*1200*
	289	*11*	*300*
T25N - R45E	-	800	800
	-	*328*	*328*
	-	*472*	*472*
T20N - R46E	246	354	600
	170	*190*	*360*
	76	*164*	*240*
T21N - R46E	102	98	200
	59	*35*	*94*
	43	*63*	*106*
T22N - R46E	225	75	300
	146	*37*	*183*
	79	*38*	*117*
T23N - R46E	204	196	400
	107	*117*	*224*
	97	*79*	*176*

(continued on following page)

	Class II	Class III	Total
T24N - R46E	48	203	251
	12	*174*	*186*
	36	*29*	*65*
T20N - R47E	654	57	711
	244	*19*	*263*
	410	*38*	*448*
T22N - R47E	398	576	974
	358	*437*	*795*
	40	*139*	*179*
T23N - R47E	-	532	532
	-	*358*	*358*
	-	*174*	*174*
T24N - R47E	201	289	490
	121	*183*	*304*
	80	*106*	*186*
T25N - R47E	-	450	450
	-	*159*	*159*
	-	*291*	*291*
T26N - R47E	110	390	500
	50	*295*	*345*
	60	*95*	*155*
T19N - R48E	270	1230	1500
	174	*681*	*855*
	96	*549*	*645*
T20N - R48E	153	747	900
	85	*500*	*585*
	68	*247*	*315*
T21N - R48E	-	500	500
	-	*310*	*310*
	-	*190*	*190*
T22N - R48E	-	500	500
	-	*180*	*180*
	-	*320*	*320*

(continued on following page)

	Class II	Class III	Total
T23N - R48E	75	2425	2500
	45	*1880*	*1925*
	30	*545*	*575*
T24N - R48E	101	529	630
	32	*207*	*239*
	69	*322*	*391*
T25N - R48E	-	50	50
	-	*42*	*42*
	-	*8*	*8*
T26N - R48E	-	2100	2100
	-	*1764*	*1764*
	-	*336*	*366*
T20N - R49E	-	500	500
	-	*165*	*165*
	-	*335*	*335*
T22N - R49E	-	700	700
	-	*448*	*448*
	-	*252*	*252*
T24N - R49E	-	2712	2712
	-	*2045*	*2045*
	-	*667*	*667*
T25N - R49E	-	1350	1350
	-	*1094*	*1094*
	-	*256*	*256*
T26N - R49E	-	3000	3000
	-	*1740*	*1740*
	-	*1260*	*1260*
T27N - R49E	30	170	200
	18	*138*	*156*
	12	*32*	*44*
T24N - R50E	385	3115	3500
	104	*2276*	*2380*
	281	*839*	*1120*

(continued on following page)

	Class II	Class III	Total
T25N - R50E	-	2950	2950
	-	*1848*	*1848*
	-	*1102*	*1102*
T26N - R50E	150	2350	2500
	24	*1826*	*1850*
	126	*524*	*650*
T27N - R50E	370	130	500
	185	*80*	*265*
DAWSON COUNTY	*185*	*50*	*235*
T20N - R50E	88	312	400
	30	*98*	*128*
	58	*214*	*272*
T21N - R50E	2700	2300	5000
	1029	*1521*	*2550*
	1671	*779*	*2450*
T22N - R50E	2450	4550	7000
	253	*1567*	*1820*
	2197	*2983*	*5180*
T23N - R50E	1118	3182	4300
	512	*2670*	*3182*
	606	*512*	*1118*
TOTALS	11,700	41,100	52,800
	5,050	*26,510*	*31,560*
	6,650	*14,590*	*21,240*
Percent by Class	22.16	77.84	100
Percent Cropland	*43.16*	*56.84*	*59.77*
Percent Rangeland	*64.5*	*35.5*	*40.23*

the plan and (2) the total acreage of land which, if developed, would replace existing cropland or rangeland by township and class.

Table VI-F shows the potentially irrigable land by township under Garfield Plan A as described in detail in Chapter V. This plan covers a total of approximately 21,360 acres. Approximately 28 percent or 6,000 acres of the 21,360 is currently in the production of crops with 72 percent or 15,000 presently in the production of dryland range. The data in Table VI-F shows that 61.5 percent of the land classified as potentially irrigable is in Class III with 38.5 percent in Class II.

Table VI-G contains detailed data as to potentially irrigable land under Garfield Plan B which includes a total acreage of approximately 10,000 acres. Over 80 percent of the acreage covered or classified as potentially irrigable land now in dryland range and also 80 percent of the land classified as potentially irrigable land is in Class III.

Table VI-H presented details as to potentially irrigable lands covered under Garfield Plan C while Table VI-I includes the same information for Garfield Plan D. The data for Garfield Plan C reveals that approximately 31 percent of the total land classified as potentially irrigable is in Class II with approximately 69 percent being Class III. Again, it is interesting to note that

the majority of the land or nearly 70 percent is presently in range land. Garfield Plan D includes approximately 4,600 potentially irrigable acres, with 80 percent being presently used as rangeland. This potentially irrigable land is again predominantly Class III with approximately 82 percent being in that category.

In consideration of the direct benefits which are attributable to any of the plans discussed for Garfield County, direct reference should be made to the details included in Table VI-F, Garfield Plan A; Table VI-G, Garfield Plan B; Table VI-H, Garfield Plan C; and Table VI-I, Garfield Plan D.

Detailed tables are also contained on the pages following for McCone Plan A, Table VI-J and McCone Plan B, Table VI-K.

The total acreage included under McCone Plan A, as described in detail in Chapter V, is 36,800 acres. Plan B contains all of Plan A plus additional extensions. The total land covered under McCone Plan B is 52,800 acres. The detailed data by township for McCone Plans A and B reveal that for both plans, slightly more than one-half or approximately 55 to 60 percent of the land which is currently classified as potentially irrigable is now in cropland with 40 to 45 percent in rangeland.

The land classified as potentially irrigable under Plan A in McCone County consists of approximately 30

percent Class II and 70 percent Class III land.

The additional lands added to Plan A to comprise Plan B, alters this percentage to 22 percent of the total land in Class II and 78 percent in Class III.

All discussions relating to the secondary or indirect benefits discussed in Section E of this Chapter, draw heavily upon the data discussed and presented here in relationship to potentially irrigable lands. Chapter VII presents an assessment as to preliminary feasibility of the individual plans described in Chapter V and summarizes the acreages of land which could be developed under each plan.

Conclusions on Agricultural Benefits

From the above discussion it is clear that the direct benefits to existing agricultural units within the study area could be very significant as a result of incorporation of new irrigated lands into those existing units. As stated previously, all judgements as to feasibility of water development in this study are based on the assumptions that new irrigated lands would be added onto existing farm units and the new irrigable land would be used by the application of top-level management and technology. In addition, most of the new irrigated lands would initially go into the production of crops in direct support of the livestock enterprise.

No attempt has been made to estimate the expected cost and expected returns from the incorporation of such new

irrigated lands, because of the extreme variability that would be associated with their use from farm to farm. It is, however, definitely concluded that very significant benefits would be derived to the individual farm or ranch units involved by the incorporation of such lands. Productivity of these properties and the benefits (direct, indirect) which result would be such that if it is shown on a preliminary feasibility basis that could be delivered to the farm at a cost of from 10 to 20 dollars per acre per year, then on a preliminary feasibility basis, the proposed water development studied here should definately be pursued in detail in order to test feasability with a more adequate and complete knowledge.

D. Municipal Water Benefits

As described in Chapter III, the current municipal water situation within the East Central Montana study area leaves much to be desired. The benefits which could be realized from an improved water supply should be examined both in terms of water quality and water quantity.

Information from Mueller Engineering of Billings was obtained in relationship to their State contract for city water engineering. Mueller's study is not an in-depth study for individual communities and therefore national trends were used for individual city water use projections. For example, average daily consumption for a city was estimated by assuming 200 gallons average consumption per person per day. Total daily consumption was then arrived at in each

case by multiplying by the appropriate historical or projected population. This method, according to Mueller, yields data which represents an ideal water supply situation and is not necessarily intended to correspond perfectly with present felt needs of the area users. Works and systems which have been proposed in Chapter V of this preliminary study do not in any case provide a municipal water supply delivered to the city limits, however, in some cases a viable supply of water would be available within reach of existing municipal water systems.

In terms of water quality there is little doubt that an alternate source of municipal water, in the Jordan and Circle areas in particular, would be desirable. Benefits accruing, however, from improved water quality are vague and difficult to quantify.

In terms of water quantity demanded, information is available for the cities of Jordan in Garfield County, Circle, Vida and Brockway in McCone County, and Richey in Dawson County. Conclusions of the Mueller study were that of the cities indicated above, all but Brockway and Vida have future needs for increased water supplies. Although Jordan's population is projected to decrease between 1970 and 1990, recommendations have been made for one additional well which would provide 135 gallons per minute (GPM). Current average daily consumption of municipal water in the Jordan community is approximately 111,000 gallons. Circle's

population is projected to increase between 1970 and 1990 with an accompanying increase in demand from their municipal water supply. Average daily consumption in the Circle community is anticipated to increase from the present 230,000 gallons to 280,000 gallons in 1990. Recommendations have been made that the Circle community provide for an additional 510 gallons per minute (gpm) which would create 680 gallons per minute (gpm) instantaneous capacity. The community of Richey in Dawson County is projected to increase in population between 1970 and 1990 with an accompanying increase in average daily consumption of municipal water from 95,000 gallons per day in 1970 to approximately 106,000 gallons in 1990. Recommendations have been to establish an additional 180 gallons per minute (gpm) capacity which would create a total instantaneous capacity of 260 gallons per minute (gpm).

There is little doubt that, within the proposed East Central Montana Water Conservancy District, the need for an improved municipal water supply exists. In view of the fact that the present water supply is limited to wells yielding water high in total solids, it has been advised that alternate sources of municipal water be examined to provide for future needs. It would be desirable for the new source of municipal water supply to be adequate both in terms of quality of water and quantity of water.

Monetary benefits derived from municipal water users could be realized to assist in subsidizing irrigation costs within the study area. The amount of such payments, however, would no doubt be quite minimal in comparison to the total cost of the systems contemplated.

E. RECREATIONAL BENEFITS

Introduction

The recreational benefits which would likely accrue to those within the study area, as a result of water development stem from three major changes. These changes within the area include: (1) improvement of live streams within the area by addition of Fort Peck water, (2) construction of regulating and holding reservoirs within the study area, (3) construction of distribution canals. It is believed that as a result of these improvements, additional recreational benefits in terms of fishing, hunting, boating, camping, and picnicing will be available to area residents.

In general, it is believed that a fishing lake should be of at least twenty acres in size to consider its value in terms of recreational benefits. Also, a lake for fishing purposes should be at least fifteen feet deep over at least 25 percent of the lake's total area. Such rules of thumb are based primarily upon weather conditions such as snow and ice during the winter, as well as evaporation during dry periods. Availability of a constant water supply such as a canal, could easily alter the above rules of thumb.

In terms of waterfowl development, 160 acres including water, dikes, and supporting fields to provide feed

is considered to be the minimum size practical. Some waterfowl development will, no doubt, result from the availability of additional canals within the study area.

In addition to the improvement of fishing and hunting, it is believed that additional opportunities in terms of camping, picnicing, and boating would be available.

Garfield Plans

In terms of recreational potential, Garfield Plan A provides for a regulating or storage reservoir of 20,000 acre-feet at the head of Smokey Butte Creek. An additional 6,000 acre-foot storage reservoir on Wolf Creek also is provided for in Plan A. Garfield Plans B and D provide no possibility in terms of regulating or storage reservoirs. Garfield Plan C provides recreational potential in terms of one 15,000 acre-foot regulating reservoir at the head of Smokey Butte Creek, but does not provide a second storage reservoir at Wolf Creek, as does Plan A. The following area streams would be affected by the addition of water to live streams: Lone Tree Creek, Smokey Butte Creek, Steve's Fork of the Big Dry, Big Dry Creek, Vail Creek, Frasier Creek, Woody Creek, and Wolf Creek. The length of existing stream channels used in the various plans are Plan A - 210 miles, Plan B - 64 miles, Plan C - 180 miles, and Plan D - 30 miles.

The length of canals included in the various plans are: Plan A - 161 miles, Plan B - 116 miles, Plan C -

123 miles, and Plan D - 55 miles.

McCone Plans

In terms of regulating or storage reservoir recreational potential, Plan A for McCone provides one 50,000 acre-foot reservoir and Plan B provides one 60,000 acre-foot reservoir. Live stream reacreational improvement, as a result of increased quantities of water, include such streams as Horse Creek, Middle and East Fork of Prairie Elk Creek, Lost Creek, Duck Creek, Cow Creek, Wolf Creek, Sheep Creek, Nickwall Creek, as well as the Redwater River. Existing lengths of the stream channels used in the McCone plans are: Plan A - 160 miles, Plan B - 260 miles. Recreational benefits, particularly in terms of hunting and fishing, result from 70 miles of canal in Plan A and 168 miles of canal in Plan B.

Summary

It is believed that a great number of recreational benefits may accrue to area residents as a result of the contemplated water development within the study area. Benefits in terms of improved fishing, hunting, boating, camping, and picnicing are no doubt an important part of these benefits. Accurate assessment of these benefits, however, is a difficult task and definitely merits additional detailed study.

F. THE MULTIPLYING OR ECONOMIC EXPANSION EFFECTS OF DIRECT BENEFITS ASSOCIATED WITH WATER DEVELOPMENT - INDIRECT BENEFITS

It should be clear from the above discussions in this chapter that water development projects, such as the one being considered in the feasibility of the establishment of a conservancy district in Eastcentral Montana, would result in significant direct benefits. These can be categorized as direct benefits associated with water development in relationship to agricultural, industrial, municipal, and recreational uses. There are certainly large measures of direct benefits associated with each of these water uses associated with development in the area.

It has been pointed out above that by changing the use of an acre from rangeland to irrigated land, gross income from that acre would increase from 40 to 60 times while the changing of an acre from dryland cropland to irrigated land would increase direct gross income from three to five times. In addition, it has also been pointed out above that there are numerous other direct benefits associated with the addition of irrigated acres to an existing farm unit. Such addition of acres affords that farm unit the opportunity to more efficiently utilize its total resources.

It has also been stressed that there would be significant recreational benefits associated with water development in the area. This recreational benefit would,

in fact, increase the general level of activity in the area and would be accompanied by an overall increase in spending.

Considerable discussion contained in earlier sections of this report reveal that water development in the area could induce and promote significant industrial development by utilizing the vast coal resources of the study area. The development of such industrial activity would directly create income and jobs in the area which are presently not available. Earlier discussions have also centered on the improvement of municipal water supplies in terms of both quantity and quality which could be associated with development of water for beneficial use within the study area.

All of the direct income benefits, which are attributable to various uses of water developed within the area, would have multiplying income effects throughout the study area. A clear example of this is that as an acre of land becomes developed as an irrigated acre, significantly more inputs must be purchased or used on that land to induce the expected productivity. The expanded use of purchased inputs would, of course, expand directly the trade activity within the area. It is also obvious that this would create additional employment opportunities for human resources in direct relationship to the agricultural development. There are definitely multiplying effects

associated with either employment or income increases, because of the very simple fact that one person's expenditures do, in fact, become another person's income. As one receives additional income, part of that income is spent and part of it is saved. The part of the increased income that is spent again, becomes income to someone else -- thus, the multiplying effects throughout an area economy as a result of expanding a specific sector. The total affect on aggregate income within the study area would be several times greater than the direct affect associated with the income increase.

It is obvious that all of the developments described above would tend to increase or stabilize the population and employment of the area. The agricultural activity, as well as the industrial activity which could be associated with development, would create jobs and employment for people in the area. Chapter II clearly reveals that the area is declining in terms of employment and population and that water development projects such as the one examined here, would tend to stabilize or increase population as well as stabilizing employment and increasing the number of job opportunities available in the area.

There is little doubt that this kind of increased economic activity would have a significant affect upon the entire socio-economic climate of the area. There would be a tendency for more services to be available within the

area, as well as more retail and wholesale-type activity. This growth again creates more jobs.

The tax base of the area would be significantly affected by water development projects. The new industrial plants and facilities would contribute directly to tax base. The construction of works to deliver the water to the various sections of the area would also create construction jobs, operation and maintenance jobs, and also contribute to expansion of the tax base.

In addition, it can be assumed that the market value of an acre of rangeland presently within the study area is approximately $20 to $40, while the present value of an acre of dryland cropland is from $75 to $100. It is fair to say that acres, which would be changed from their present use and developed as irrigated acres, would expand the per acre value of such property to from $300 to $400 - an expansion of the existing tax base on these acreages by several multiples.

In conclusion, it is obvious that there are many indirect benefits which would be associated with water development such as that described herein. These indirect benefits are of major importance and should be examined in clear and specific detail in any detailed feasibility study which intends to accurately assess the desirability of designated water development projects. Such benefits are certainly, however, recognized as having an extremely positive effect.

CHAPTER VII

PRELIMINARY ANALYSIS OF SYSTEMS FEASIBILITY

CHAPTER VII

PRELIMINARY ANALYSIS OF SYSTEMS FEASIBILITY

A. IDENTIFICATION OF IMPORTANT COST VARIABLES TO ASSESSING FEASIBILITY

Introduction

The assessment or judgement as to preliminary feasibility as called for in the conducting of this study falls into two specific categories, as clearly spelled out in Chapter I of this report.

One key question that needs to be answered as stated In Chapter I is as follows: "Test on a preliminary feasibility basis the desirability or likely potential feasibility of works contemplated within the proposed conservancy district. In this study these works are primarily centered on the question of distributing water from Fort Peck Reservoir into part or all of the study area to be put to beneficial uses in the area."

The details in terms of the systems which have been considered as well as detailed engineering material as to costs of such systems are spelled out in Chapter V of this report. The result of this work is all contained in an estimate as to the annual cost of water per acre of irrigated land assuming the water is delivered to the individual farm units or potentially irrigable acres considering the works of the various systems.

The research contained in this preliminary feasibility study started from the very beginning in terms of conceiving the alternate systems as well as the identification and location of potentially irrigable lands in the study area. Chapter V, as stated previously, presents the works involved in the various systems and states the acreages of land which would be potentially irrigable under each system. The results of this research are shown in the detailed maps supplied as a part of this report.

Engineering Cost Variables in Assessing Feasibility

It is obvious that a preliminary feasibility study involving the design of systems, such as those presented in Chapter V, necessarily results in many estimates as to the costs which would be associated with the various plans in question. Chapter V clearly spells out many of the problems that are associated with the costing out of various segments of the systems.

All of the systems involved significant costs associated with the pumping of water from Fort Peck Reservoir to higher elevations for distribution within the study area. It is extremely difficult to accurately reflect the costs which will be associated with such pumping operations because of the very specialized kinds of equipment involved that is not on the market at well-established market price in that most of it would be specially designed

by an individual manufacturer for the specific purpose intended. It is thus extremely difficult to pinpoint precisely the costs which would be associated with these kinds of equipment.

It is also certain that the various alternate plans presented require extremely large quantities of specialized equipment in terms of not only pumps, but pressure pipeline and other specialized items in relationship to the pumping plants involved. This necessarily causes cost estimation problems, because of the large quantity of such equipment which is necessary and also the complexity of the equipment in terms of design.

Another extremely complex item to estimate is the cost per kilowatt-hour of power or energy to be used in the pumping of water for these systems. There are extremely large quantities of power required in nearly all of the systems examined in Chapter V and the assumption made in terms of power cost is indeed a critical assumption to assessment of feasibility for the various systems. The power costs account for a major portion of the operation and maintenance (O & M) cost associated with the water delivery systems. It is possible that power could be supplied through the Corps of Engineers or through power generated in the area as a result of electrical generation plants using coal resources. Such power may be available at significantly less cost than has been assumed in this

study. This is, however, a critical assumption for which it is extremely difficult to pinpoint precise data at this time.

Another very critical assumption which had to be made in terms of the engineering data assembled for each alternate plan involved estimation of the canal lengths necessary to transport water from one point to another within the study area. It is obvious to those acquainted with the area that the existing terrain is in many instances rough and broken. This necessitates extremely long canals to transfer water from one point to another. The precise routing of canals and the length of canal needed could vary considerably from what is included in the cost estimates, because in addition to having rough and broken terrain, the contour maps available for use throughout most of the area were somewhat limited. Therefore, the canal lengths which are included in the costing of the various plans could vary considerably from what is indicated in Chapter V.

Again, the assumption concerning canal lengths is indeed a very important item, which contributes significantly to the costs associated with the various engineering plans presented in Chapter V.

In summary, the engineering detail presented in Chapter V is intended to represent the best possible estimate of construction and O & M costs which would be associated

with the various plans. It is recognized that these are preliminary estimates and that because of certain problems discussed above, these estimates could vary somewhat in actual implementation. This discussion is in no way intended to discredit any of the estimates which are included in the engineering detail in Chapter V. Rather, they point out that in assessing feasibility, such estimates should be critically analyzed, at least in part, to determine what effect there would be in terms of the overall feasibility if the estimates were to change. This type of analysis will be conducted in this chapter, before final judgements are rendered as to the possible or probable feasibility of the various water development plans in question.

Acreage Included Under Various Assumptions

The cost per acre irrigated varies significantly as one changes the total number of acres reached by the various systems. This is true primarily because the capacity of the system would allow for some variances in the number of acres included under the system, with very little accompanying change in construction costs.

It must certainly be recognized that the potentially irrigable acres, as identified and described in detail in Chapter III, are best estimates as to the total acreages and location of potentially irrigable lands. It is clearly stated in Chapter III that a detailed soil survey and other

detailed work would need to be undertaken before final judgements are made as to the actual identification of potentially irrigable lands. It is also stated in Chapter III that the acreage of potentially irrigable lands which have been identified probably understate the actual quantity of land which would prove to be potentially irrigable, given such a detailed soil survey. This fact alone makes it entirely possible that the number of acres which have been classified as potentially irrigable under each of the various plans could vary significantly--again, a factor which would affect water cost per acre.

It was also stated in Chapter V that the potentially irrigable acres which would be reached by the system were identified on the basis of those lands which had previously been classified as potentially irrigable. Basically, the acreages reached were located within one-half mile of the water source and within 100-feet elevation of the water source. Again, it is possible that the actual resulting number of totally potentially irrigable acres which would be included under each of the systems could be at variance from what is indicated in Chapter V. Thus, this variable should be examined also as to its effect on cost per acre before judgements as to preliminary feasibility are made.

Terms of Construction Cost and Debt Retirement Charged to the Irrigation User

There are many ways to view the retirement of construction costs or the assignment of construction costs, on an

annual basis, to the potentially irrigable lands under each system.

Obviously, it is possible to receive an entirely different cost per acre if 100 percent of the construction costs are assumed paid for by the irrigation project than if 100 percent of the construction costs plus interest payments are paid by the project. There are many variables concerning debt retirement which would significantly affect costs of water per irrigated acre.

The first would relate to the retirement of debt incurred in construction costs and the percentage of the debt charged to the project. Some projects have 100 percent of the construction costs assumed, while in others, none of the construction costs are charged to the irrigation water user. This assumption is, of course, very significant to designation of cost per acre associated with water under the various projects.

A second important factor regarding the retirement costs is the portion of interest, if any, which is charged to the irrigation water user. The interest rate itself is also very important.

A third important consideration with respect to the charging of construction costs to the irrigation water user is the number of years over which the construction cost is to be retired. This varies significantly from 20 to 100 years in various projects. All of these factors

are important and have their impact on the costs per acre charged to the irrigation water user.

Returns From the Industrial and Municipal User

It is very obvious from the material presented in Chapter IV and also material presented in Chapter VI, that the development of coal resources in the area is greatly enhanced by water availability on site. Tables V-C, V-H, V-I, and V-J in Chapter V contain various assumptions regarding returns from the industrial user under the various irrigation plans. These tables show the effect of water sale to an industrial user upon the cost per irrigated acre. All of the data presented in Chapter V assumes an annual use of 7,200 acre-feet of water, prices at $50, $75, and $100 per acre-foot.

Both the quantity of water used and the price associated with its use are very important in terms of assessing the dollar amount required per acre irrigated from the irrigation user. Therefore, these two variables representing quantity and cost of water for industrial use are indeed important in judging preliminary feasibility of the various systems.

In addition, the dollar return for the supplying of improved quantities and qualities of municipal water in the various municipalities of the area is also important. The expected dollar return received from the municipal

water user is expected to be relatively small. However, it is clear that the quality of water now available to the people in the municipalities of the study area is very poor; and as stated in Chapter VI, it is difficult to assign a dollar value to the improvement of quality. It is, however, obvious that there is some associated dollar value which could logically be associated with the supplying of more adequate municipal water, both in terms of water quantity and water quality.

B. ANALYSIS AND VARIANCE OF IMPORTANT COST VARIABLES FOR ASSESSING FEASIBILITY

Introduction

As a result of the above discussion, it is clear that many variables exist which are of key importance to the assessment of preliminary feasibility for any one of the proposed systems as presented in Chapter V and discussed in Chapter VII. Many of the cost components presented in Chapter V could be expected to vary from the original estimates. In assessing preliminary feasibility, it is critical to examine the impact of the variants on total cost per irrigated acre. Certain cost components can vary significantly with little effect upon the total cost, while minor variances in other cost components may exert a very significant effect.

All of the analysis is presented in terms of varying these particular items by system and observing their effect on total cost per acre irrigated. The focal point of all discussion relative to judgments on preliminary feasibility is focused on cost per acre irrigated under the systems. In previous sections of this report, the cost per acre irrigated under each system has been examined only on a total cost basis; but, in this section the total cost per irrigated acre is broken down into its distinct components which contribute individually to the total cost as presented in Chapter V.

Construction Costs and Debt Retirement

The first item, which is examined in relationship to its contribution to the total cost per acre irrigated under each system, is the terms of debt retirement. Table VII-A indicates the construction costs per acre, assignable to the irrigation user, assuming 100 percent user financing of the incurred debt. Table VII-B accomplishes a similar task, showing construction costs per acre, assignable to the irrigation user, assuming 50 percent user financing.

In both Tables VII-A and VII-B, three different assumptions as to interest rate are included--3.5 percent, 4.5 percent, and 5.5 percent. In addition, for each of the interest rates, there are three assumptions made as to the number of years over which the debt is to be retired.

TABLE VII-A

ANNUAL ASSIGNABLE CONSTRUCTION COSTS ASSUMING 100 PERCENT REPAYMENT BY THE USER PER IRRIGATED ACRE FOR THE DIFFERENT PLANS ASSUMING VARIOUS INTEREST RATES AND YEARS FOR RETIREMENT.*

Years for Retirement	Interest Rates					
	5½	4½	3½	5½	4½	3½
	McCone A			McCone B		
40	21.17	18.45	15.90	22.42	21.25	19.89
50	20.05	17.20	14.48	19.56	18.20	16.40
100	18.78	15.49	12.28	18.86	15.34	13.01
	Garfield A			Garfield B		
40	48.92	46.35	43.40	56.09	53.12	49.74
50	42.65	39.78	35.77	48.93	45.55	40.94
100	36.75	33.47	28.37	42.17	38.38	32.55
	Garfield C			Garfield D		
40	42.61	40.40	37.79	33.48	31.73	29.76
50	37.17	34.62	31.16	29.32	27.13	24.51
100	32.01	29.18	24.75	25.17	22.98	19.48

* Assumes no water sale for industrial use.

TABLE VII-B

ANNUAL ASSIGNABLE CONSTRUCTION COSTS ASSUMING 50 PERCENT REPAYMENT BY THE USER PER IRRIGATED ACRE FOR THE DIFFERENT PLANS ASSUMING VARIOUS INTEREST RATES AND YEARS FOR RETIREMENT.*

Years for Retirement	Interest Rates					
	5½	4½	3½	5½	4½	3½
	McCone A			McCone B		
40	10.59	9.23	7.95	11.21	10.62	9.94
50	10.03	8.60	7.24	9.78	9.10	8.20
100	9.39	7.74	6.14	9.43	7.67	6.50
	Garfield A			Garfield B		
40	24.46	23.17	21.70	28.04	26.56	24.87
50	21.37	19.89	17.88	24.46	22.77	20.47
100	18.37	16.73	14.18	21.08	19.19	16.28
	Garfield C			Garfield D		
40	21.30	20.20	28.89	16.74	15.86	14.88
50	18.58	17.31	15.58	14.16	13.56	12.25
100	16.00	14.59	12.37	12.58	11.49	9.74

* Assumes no water sale for industrial use.

The number of years considered for retirement include 40, 50, and 100 years.

As an example, one can turn to Table VII-A, which assumes 100 percent irrigation user financing of the construction costs, and for any combination of interest rate and years can be found the assignable construction cost per acre for each proposed system. Under McCone Plan A, the assignable annual construction cost per acre for irrigation water, assuming a 40-year retirement and 5.5 percent interest, would be $21.17. The corresponding cost for Garfield B, under the same assumptions, would be $56.09. Again, it is possible to determine for any one of the proposed systems what the annual assignable construction costs per irrigated acre would be for an interest rate of 3.5 percent and a retirement term of 100 years or for any other such combination.

No table is shown which varies the original construction cost. It is recognized that this cost component will likely vary from the original estimates. This is due primarily to the difficulty involved in accurately estimating pump costs, pipeline costs, and ditching costs. It is obvious, however, that once the annual construction costs are assigned to an irrigated acre under any particular plan, then as the total construction varies by a given percentage, the cost assignable per acre would vary by that same percentage. For example, in Table VII-A, the

annual assignable construction cost per acre for McCone Plan A is $21.17. This cost assumes 100 percent debt retirement over forty years at 5½% interest. If it is assumed that the construction costs are lowered by twenty percent, then the original cost per acre irrigated ($21.17) would also be lower by twenty percent. This relationship enables the reader to make various assumptions concerning this cost component.

Operation and Maintenance Cost by Category

Tables VII-C, VII-D, VII-E and VII-F each contain information as to the assignable annual cost per acre to the irrigation user under various assumptions regarding operation and maintenance (O and M) costs.

Table VII-C shows the possible variations in cost per acre for annual pumping power under the different plans presented. Power costs are included at four specific levels - 3, 3½, 4 and 2½ mills per KW hour. This cost component induces a very significant effect, as is clearly shown in Table VII-C. For example, for Garfield Plan D, the power cost per KW hour is $5.90 per acre irrigated assuming power at 3 mills and $4.92 , assuming power at 2½ mills. This variance of ½ mill per KW hour results in approximately one dollar per acre variation in irrigation costs.

Table VII-D shows the variations in cost per acre irrigated for annual pump maintenance, labor cost, and other miscellaneous maintenance for the six different plans assuming a ten percent increase or decrease in the estimated cost.

TABLE VII-C

VARIATIONS IN COST PER IRRIGATED ACRE FOR ANNUAL PUMPING POWER COSTS FOR DIFFERENT PLANS ASSUMING SELECTED POWER COSTS PER KW HOUR.*

Plan	Power Cost per KW Hour			
	3 mills	3½ mills	4 mills	2½ mills
McCone Plan A	$11.34	$13.23	$15.12	$ 9.45
McCone Plan B	11.64	13.58	15.52	9.70
Garfield Plan A	19.47	22.71	25.96	16.22
Garfield Plan B	23.76	27.72	31.68	19.80
Garfield Plan C	18.36	21.42	24.48	15.30
Garfield Plan D	5.90	6.88	7.87	4.92

* Assumes no water sale for industrial use.

TABLE VII-D

VARIATIONS IN COSTS PER IRRIGATED ACRE FOR ANNUAL PUMP MAINTENANCE, LABOR COST, AND OTHER MISCELLANEOUS MAINTENANCE FOR DIFFERENT PLANS ASSUMING A 10 PERCENT INCREASE OR DECREASE IN ESTIMATED COSTS.*

Plans	Study Cost Estimate	10 Percent Increase	10 Percent Decrease
McCone Plan A	$4.95	$5.45	$4.46
McCone Plan B	4.77	5.25	4.29
Garfield Plan A	8.52	9.37	7.67
Garfield Plan B	11.67	12.84	10.50
Garfield Plan C	7.99	8.79	7.19
Garfield Plan D	10.94	12.03	9.85

* Assumes no water sale for industrial use.

These costs do not account for a large percentage of the total cost associated with the cost per irrigated acre. Therefore, a ten percent change tends to have a relatively minor effect in terms of the total cost per acre irrigated under each plan. For example, in Garfield Plan C a ten percent increase would only increase the cost per acre irrigated from a level of $7.99 to a level of $8.79.

System Efficiency

Another key variable which has to be identified in the estimation of costs associated with any particualr system is the efficiency with which the irrigation system would operate in delivering water to the land involved. It is obvious, as pointed out in detail in Chapter V, that the canal lengths as well as the use of the stream channels tends to decrease the efficiency of the system. It is, however, recognized that this variable could vary significantly from what has been assumed in this study. The data presented in Table VII-E shows the effect of such a change. It was assumed in the construction of Table VII-E that a twenty percent change in the total efficiency of the system would result in a fifteen percent change in total cost. In other words, it was assumed that if twenty percent less water were required in the system per acre irrigated, then the cost would decrease by an amount of fifteen percent.

This variable, indeed, does have a very significant impact

TABLE VII-E

VARIATION IN COST PER IRRIGATED ACRE ASSUMING SYSTEM EFFICIENCY CHANGES OF 20 PERCENT[1]

Plans	Study Cost Estimate	20% Efficiency[2] Decrease	20% Efficiency[2] Increase
McCone Plan A	$26.91	$30.95	$22.87
McCone Plan B	27.63	31.77	23.49
Garfield Plan A	52.00	59.80	44.20
Garfield Plan B	63.00	72.45	53.55
Garfield Plan C	48.00	55.20	40.80
Garfield Plan D	34.00	39.10	28.90

[1] Assumes no water sale for industrial use

[2] A 20 percent change in efficiency results in a 15% change in total cost.

in that McCone Plan A shows a study cost estimate of $26.91 for the cost per acre irrigated and with a 20 percent efficiency increase this would lower the cost of $26.91 to $22.87 accounting for a difference of approximately $4. This table is different than the previous tables presented in this analysis in that the effect of different assumptions are shown directly on the total cost per acre irrigated while all of the other tables, VII-A through VII-E, contain data dealing specifically with particular components of the total cost. This same type of analysis carries into the material contained in Table VII-F.

Acreage Reached

Table VII-F assumes a variation in the number of acres reached with each one of the systems. The material contained in Table VII-F is similar to that contained in Table VII-E. In Table VII-F, it is assumed that a 20 percent change in acreage would result in approximately a 15 percent change in total cost. In other words, it is assumed that if the acreage covered under a particular system is increased by 20 percent that the costs would increase by only 15 percent.

Because of the fact that the acreage increase is in large part offset by a corresponding cost increase, the impact of varying acreage is less than would have been expected. Table VII-F, for example, shows that for McCone Plan B a 20 percent increase in the number of acres served

TABLE VII-F

VARIATIONS IN COST PER IRRIGATED ACRE ASSUMING IRRIGATED LAND UNDER EACH SYSTEM IS INCREASED BY 20 PERCENT[1]

Plans	Study Cost Estimate	20 Percent[2] Average Increase
McCone Plan A	$26.91	$25.79
McCone Plan B	27.63	26.48
Garfield Plan A	52.00	49.83
Garfield Plan B	63.00	60.37
Garfield Plan C	48.00	46.00
Garfield Plan D	34.00	32.58

[1] Assumes no water sale for industrial use

[2] A 20% change in acreage results in a 15% change in total cost

lowers the total cost per acre irrigated by just slightly over a dollar. This is true because as acreage goes up the system costs also increase.

Industrial Water Returns

It is clear that the aspect of industrial development in relationship to the coal reserves of the area is a very important consideration to this study. This matter is covered in detail in Chapters IV, V and VI of this report. This is especially true when one looks at the possible contributions or reductions in the cost per acre irrigated by the sale of water for industrial use. Table VII-G contains data examining the importance of the assumption made concerning this variable.

Table VII-G contains three different assumptions as to the acre feet of water required for industrial use as well as three prices associated with the price paid by the industrial user per acre-foot. The three levels of use are 7,200, 10,000 and 15,000 acre-feet per year, with three different prices of $50, $75 and $100 per acre-foot. It is possible to calculate the dollar return in total from the industrial user and by dividing the number of acres included in the system into the acre-feet of water used for industrial purposes times its price. The reduction in cost per irrigated acre which would result under the various plans through the sale of water for industrial purposes is shown

in Table VII-G. This material is presented only for McCone Plan A and McCone Plan B because no industrial water use has been assumed in any of the plans in Garfield County because of the lack of identification or of any industrial user possibilities in that specific area.

This industrial user return is indeed a crucial variable to the entire study. For example, Table VII-G shows that the reduction in cost is very, very significant in cost per irrigated acre as one varies either the quantity of the water sold for industrial use or the price. Many of the reductions exceed ten to twenty dollars per acre under the various assumptions assumed in that table. This is an extremely critical variable to the assessment of feasibility of the projects in McCone Plan A and McCone Plan B.

It is discussed later in this Chapter, in terms of the conclusions as to preliminary feasibility, that the assumption which is made regarding the quantity and price of water sold for industrial use is probably the key or determining variable in the entire analysis. There is little doubt but what a feasible project exists, at least on a preliminary basis, under either McCone Plan A or McCone Plan B, if an industrial user of water can be found which requires the quantity of water and is willing to pay the price assumed and shown in Table VII-C.

TABLE VII-G

CONTRIBUTIONS TO COST PER IRRIGATED ACRE BY SALE OF WATER FOR INDUSTRIAL USE FOR MCCONE COUNTY

Acre Feet of Water for Industrial Use	Price for Industrial Water/acre ft.	Dollar Return from Industrial Water	Reduction in Cost per Irrigated Acre Industrial Sale	
			Plan A[1]	Plan B[2]
7,200	$50.00	360,000	$ 9.78	$ 6.82
7,200	75.00	540,000	14.67	10.23
7,200	100.00	720,000	19.57	13.64
10,000	50.00	500,000	13.59	9.47
10,000	75.00	750,000	20.38	14.20
10,000	100.00	1,000,000	27.17	18.94
15,000	50.00	750,000	20.38	14.20
15,000	75.00	1,125,000	30.57	21.31
15,000	100.00	1,500,000	40.76	28.41

[1] Assumes 36,800 irrigable acres

[2] Assumes 52,800 irrigable acres

Summary

The components of total annual cost per acre irrigated for the various plans, as described above and included under various assumptions in the accompanying tables, fall into four specific categories. These categories are as follows: 1) assigned construction costs, 2) pumping power costs, 3) pump maintenance, labor and other miscellaneous maintenance costs and 4) potential reduction in annual cost per acre irrigated resulting from the sale of water to an industrial user.

In addition to these variables, several other factors have been analyzed as to their impact on total cost per acre irrigated. These factors relate to system efficiency (Table VII-E) and acreage served under each system (Table VII-F).

It is then possible, with the information contained in Tables VII-A, B, C, D and G, to take any set of assumptions and thus arrive at a total cost per acre irrigated. Each of these tables is based upon a variety of assumptions concerning each of the cost component variables. In summary, it is possible to use any combination of these assumptions in arriving at a total annual cost per acre irrigated under a given plan.

To further demonstrate the use of this data three tables have been constructed, namely Tables VII-H, VII-I and VII-J. The material in Table VII-H indicates the breakdown,

by cost component, of the total annual cost per acre irrigated for each of the six plans. The same set of assumptions, which were assumed in arriving at the cost per acre presented in Chapter V, are employed here. Table VII-H shows the source of each component cost and also the source where this total cost was previously included in the study. Examination of Table VII-H then reveals that for McCone Plan A, assigned construction cost per acre under the assumption of 40 years, 5 1/2 percent interest and 100 percent user financing is $21.17. Pumping power costs at three mills per KW hour are $11.34 and other maintenance costs are $4.59. These costs account for a total annual cost per irrigated acre of $37.46. As a reference Table V-K in Chapter V, showed an estimated cost per acre under this exact set of assumptions of $37.44. (Slight difference results from rounding-) Likewise, the same data is included for the other five plans under the assumption of 100 percent user financing (Table VII-H). Table VII-I presents the same itemization of annual costs per irrigated acre assuming 50 percent user financing. Again, each of the six plans had previously been costed on a total cost per acre basis in Chapter V under the exact assumptions contained in Table VII-I.

Table VII-J accomplishes the same task as did Table VII-H and Table VII-I, but includes assumptions concerning the potential reduction in per acre costs which would result under various assumptions concerning the sale of water to an

TABLE VII-H BREAKDOWN BY COST CATEGORY OF TOTAL ANNUAL COST PER IRRIGATED ACRE FOR THE VARIOUS PLANS*

Cost Category	Table Source	McCone A	McCone B	Garfield A	Garfield B	Garfield C	Garfield D
				100% User Financing			
Assigned Construction Costs, 40 yrs. 5½%	VII-A	$21.17	$22.42	$58.92	$56.09	$42.61	$33.48
Pumping Power Costs (3 mills/KW hr.)	VII-C	11.34	11.64	19.47	22.76	18.36	5.90
Pump Maintenance, labor costs & other Misc. Maintenance	VII-D	4.95	4.77	8.52	11.67	7.99	10.94
Total Cost	-	$37.46	$38.83	$76.91	$90.52	$68.96	$50.32
Estimated Cost/Acre (Chapter V)	-	$37.44	$38.90	$77.00	$91.00	$69.00	$50.00
Table Source	-	V-K	V-K	V-F	V-F	V-F	V-F

* Assumes no sale of water for industrial use.

TABLE VII-I

BREAKDOWN BY COST CATEGORY OF TOTAL ANNUAL COST PER IRRIGATED ACRE FOR THE VARIOUS PLANS*

Cost Category	Table Source	McCone A	McCone B	Garfield A	Garfield B	Garfield C	Garfield D
				50% User Financing			
Assigned Construction Costs, 40 yrs. 5½%	VII-B	*$10.59*	*$11.21*	*$24.46*	*$28.04*	*$21.30*	*$16.74*
Pumping Power Costs (3 Mills/KW hr.)	VII-C	*11.34*	*11.64*	*19.47*	*23.76*	*18.36*	*5.90*
Pump Maintenance, labor costs & other misc. Maintenance	VII-D	*4.95*	*4.77*	*8.52*	*11.67*	*7.99*	*10.94*
Total Cost	-	*$26.88*	*$27.62*	*$52.45*	*$63.47*	*$47.65*	*$33.58*
Estimated Cost/Acre (Chapter V)	-	$26.91	$27.60	$52.00	$63.00	$48.00	$34.00
Table Source	-	V-K	V-K	V-F	V-F	V-F	V-F

* Assumes no sale of water for industrial use

TABLE VII-J
COST PER ACRE IRRIGATED UNDER 100 PERCENT AND 50 PERCENT USER FINANCING ASSUMING VARIOUS INDUSTRIAL USER RETURNS - MCCONE PLAN A AND MCCONE PLAN B

Power Use Assumption	Cost Reduction from Industrial User		100% of Construction Paid by User		50% of Construction Paid by User	
	McCone A	McCone B	McCone A	McCone B	McCone A	McCone B
No Water Sale	-	-	37.46[1]	38.83[1]	26.88[2]	27.62[2]
7200 Acre ft. at $50	9.78[3]	6.82[3]	27.68[4]	32.01[5]	17.10[6]	20.80[7]
7200 Acre ft. at $75	14.67[3]	10.23[3]	22.79[4]	28.60[5]	12.21[6]	17.39[7]
7200 Acre ft. at $100	19.57[3]	13.64[3]	17.89[4]	25.19[5]	7.31[6]	13.98[7]

[1]Source Table VII-H
[2]Source Table VII-I
[3]Source Table VII-G
[4]Data comparable to assumption in Table V-G
[5]Data comparable to assumption in Table V-I
[6]Data comparable to assumption in Table V-H
[7]Data comparable to assumption in Table V-J

industrial user. Portions of the data presented in Table VII-J were also presented in Chapter V, as footnoted on the table.

To again demonstrate the use of data presented in the accompanying tables, an annual cost per acre irrigated for McCone Plan B may be constructed under the following assumptions:

1. 50 percent of the construction costs paid by the user,
2. debt financed over 50 years,
3. interest rate 4 1/2 percent,
4. power available at 2 1/2 mills per KW hour,
5. maintenance cost as presented in Chapter V,
6. sale of industrial water of 10,000 acre-feet at $75 an acre-foot.

Under this set of specific assumptions, which are recognizably different from those contained in Chapter V, the resulting annual cost per irrigated acre is $9.37. The component costs comprising this total of $9.37 are: $9.10 construction costs retired over 50 years at 4 1/2 percent interest (50 percent user financing), $9.70 for pumping power at 2 1/2 mills and $4.77 for annual pump maintenance and other labor costs accounting for a sub-total of $23.57. From this sub-total of $23.57 there is a reduction in cost per acre of $14.20, assumed on the basis of sale of 10,000 acre-feet of water to an industrial user at $75 per acre-foot. The

resulting cost, there, is $9.37 per acre irrigated. It should be pointed out that in the above example, the system efficiency, original construction cost and the number of acres included under each proposed system are assumed exactly as they were estimated in Chapter V. Data has been included, of course, which will allow variation of any of these factors.

C. SUMMARY AND CONCLUSIONS

1. Numerous variables have been estimated in this study to arrive at the total annual cost per acre irrigated under each of the plans. These variables as discussed above can logically be expected to vary somewhat from the estimates which are included in this study. All judgments as to feasibility should take into full account the likelihood of these variances.
2. On a preliminary feasibility basis it would appear that the systems as outlined for Garfield Plan A, Garfield Plan B and Garfield Plan C are definitely of questionable feasibility. This conclusion assumes that there is to be no return to any of these systems through the sale of industrial water. Additionally, this conclusion is based on the state of technology as we know it today. Future technological changes could certainly alter the feasibility of these plans. The conclusion reached at this time would definitely

be, however, that these plans as presented are probably not feasible.

3. The detailed material presented for Garfield Plan D implies that this plan warrants further study. The cost per acre of land irrigated under this plan, as presented in Chapter V, is indeed quite high. However, the variation of certain key cost components could, in fact, present a situation where this plan would be deemed feasible. It is definitely suggested that Garfield Plan D receive further detailed consideration.

4. McCone Plan A and McCone Plan B appear to be of questionable feasibility if one does not assume any return from the sale of water to an industrial user, however, within a range which definitely warrants further detailed study.

5. Little doubt exists but what McCone Plan A and McCone Plan B do suggest a high probability of feasibility when considering industrial use of water. Preliminary feasibility is particularly apparent if under the assumption that industrial water can be sold at a minimum level of 7,200 acre-feet per year at a price of between $50 and $100 per acre-foot. Under these assumptions, it is quite clear that the plans, as presented in McCone A and McCone B, suggest strong probability of developing as feasible projects.

CHAPTER VIII

PRELIMINARY ANALYSIS OF CONSERVANCY DISTRICT FEASIBILITY

CHAPTER VIII

PRELIMINARY ANALYSIS OF CONSERVANCY DISTRICT FEASIBILITY

A. WATER DEVELOPMENT POTENTIAL OF THE AREA

It has been clearly pointed out in this preliminary feasibility study that there is a considerable amount of water development potential in the study area. This is substantiated by the following findings:

1. The conservancy district law provides for an opportunity for a great deal of local involvement in all operations of the district. The law is also written in such a way that there is a major amount of responsibility placed in the hands of the local people and the Montana Water Resources Board for organization and operation of a conservancy district to enhance water development in the area. (Chapter I)
2. The area has need for development to improve the economy of the area in that the economy is now characterized by declining population, employment and general economic activity. (Chapter II)
3. The area has large acreages of potentially irrigable lands. (Chapters III and VI)
4. The agricultural economy of the area would receive great benefit from water development in the form of not only increased gross returns but in the form of better utilization of all resources. (Chapters III and VI)

5. The area has very significant coal resources which, if developed for industrial purposes would require large quantities of water and in turn, its development would greatly enhance the feasibility of other water development projects in the area. (Chapter V and VII)
6. There are alternative system plans which have been studied on a preliminary feasibility basis which suggest there is a strong probability of developing feasible projects, given further study and research. (Chapters V and VII)
7. Direct benefits could be realized by carefully planned water development in the area for municipal and recreational uses as well as for the industrial and agricultural uses discussed. (Chapter III, IV, V, VI, VII.)
8. Many secondary benefits of extreme importance would result from water development of the area. (Chapter II and VI)

The Conservancy District Boundaries

The recommendations on the basis of this preliminary feasibility study as to boundaries are as follows:

1. The northern boundary be the Missouri River and Fort Peck Reservoir beginning at a point where the Musselshell River runs into the Missouri River in the extreme north-west corner of Garfield County.
2. The western boundary is recommended to be the ridge

which divides the Musselshell River drainage area from Missouri-Fort Peck drainage area. The ridge runs through the western portion of Garfield County beginning in the extreme north-west corner of the county in T19N R30E and ending on the southern border of Garfield County in T13N R34E.

3. The southern boundary is recommended to be the southern boundary of Garfield and McCone Counties to that point where the southern boundary of McCone County intersects the western boundary of Dawson County.

4. The eastern boundary is the ridge in Dawson and Richland Counties which divides the Missouri-Fort Peck drainage area from the lower Yellowstone River drainage area. In addition the northern portion of the eastern boundary,which is mainly in Richland County,is the boundary within the Fort Peck-Missouri drainage which divides the region in such a way that all of the area which drains into the Redwater River drainage is included in the district. All lands which lie in to the east of the Redwater River drainage area are excluded from the district.

It is strongly recommended that a detailed feasibility study for the East Central Water Conservancy District consider, in more detail, the questions of the eastern and southern boundaries of the district. This preliminary survey

did not consider any lands to the south of the county lines of McCone and Garfield Counties. Likewise, the material assembled in this study was bounded on the east by the Redwater drainage area in Richland County.

It is recognized here that further study could support the position that boundaries be changed from those recommended above on the basis of the research completed in this preliminary feasibility study. Certain of these possible changes, to be examined as suggested above, are as follows:

1. Re-define the southern boundary in such a way that it would be moved slightly to the south to include all of Missouri-Fort Peck drainage area. This would then include extremely small portions of Rosebud and Custer Counties and a somewhat larger portion of Prairie County.
2. Re-define the eastern boundary to include all lands in Dawson and Richland Counties which are a part of the Missouri-Fort Peck drainage area instead of excluding those which lie to the east of the Redwater River drainage.

C. THE ROLE OF THE CONSERVANCY DISTRICT

Some confusion appears to exist with regard to the conservancy district's function in area water development. Two schools of thought apparently prevail: (1) The conservancy district as an all e compassing entity which organizes, plans and promotes as well as actually constructing th works involve and (2) the conservancy district as an entity which has as it primary function the planning, organization and promotion of area water developments. Under the second approach, the assumption is advanced that some entity, other than the conservancy district itself, could likely be involved in the construction of project works.

The second school of thought, then, provides a somewhat more objective approach to area water development. It is based upon the premise that a large, unified body, such as the conservancy district, is necessary to foster and promote water development, which would likely benefit the entire area. Such a broadly defined organization would provide a sound organizational base with sufficient muscle to see many projects through to the implementation phases. Similar projects, supported and promoted by more narrowly defined organizations would, it is believed, be less likely to succeed.

The second school of thought, it should be noted, does not make any tacit assumptions regarding the conservancy district's role in constructinn of project works. This more objective approach is based upon the realization that the most

appropriate means of implementation may vary among different projects. Some water development works, it is believed, could be better implemented under previously existing water development laws. Development possibilities contained in the provisions of such laws as those pertaining to: (1) County Water and Sewer Districts, (2) Soil and Water Conservation Districts, (3) County and Municipal Participation in Flood Control and Water Conservation, (4) Rural Special Improvement Districts, (5) Irrigation Districts, (6) Drainage Districts, and (7) others, should be carefully examined before project implementation.

It is believed that for meaningful and effective area planning, some type of guiding organizational structure should precede the planning efforts. There is an apparent difference in the degree of practical applicability of various laws stemming from the fact that certain laws are based upon organization preceding planning while others are not.

In addition, special examination should be given the existing laws to determine their individual complexities with regard to legal requirements such as voting, court hearings, etc. The means which is ultimately chosen to implement the project works, should maximize the efforts contributed in the shortest period which is realistically practical. The above discussion, however, in no way precludes the use of provisions within the Conservancy District law for actual implementation of proposed project works.

What is definitely recommended is that serious consideration be given to the alternate methods of project implementation - while at all times keeping in mind the desired role and scope of the Conservancy District itself.

There are, indeed, many functions which the Conservancy District could and should perform, if organized and in operation As stated above, this may or may not involve the actual construction and operation of any specific projects.

It is anticipated that few, if any, of the projects would directly affect all people and land included in the Conservancy District. The Conservancy District should undoubtedly serve as a local power group to study and aid in the implementation and promotion of many different kinds of individual development projects.

One such example of a project which the district could promote and help organize but not construct or operate would be an SCS 566 project. Many fine projects of this nature have, indeed, failed to be initiated in the past, due to the lack of organized local support groups to aid in development of the project. The materials presented in this study identify the potentially irrigated lands. Many small projects in certain drainage areas may be feasible, given more information than is available at this time.

The conservancy district should be organized in such a way as to foster and develop a maximum amount of local involvement and support for projects in the conservancy district area which directly contribute to the socio-economic well-

being of the area and its residents. The district has the power to work through and with all existing programs and laws available for water development projects. The district should in no way be operated to the disadvantage of the area residents, by failure to coordinate water development under existing and new programs, because the local people and only the local people control the district.

On the basis of the above statements and the research performed in this preliminary feasibility study, it is strongly recommended that the local people of the study area carefully consider the desirability of taking the definite steps necessary to form a water conservancy district to promote and foster water development projects in the area. The taking of such steps and formation of a water conservancy district would appear to be very desirable for the people of the area and the State of Montana, based on the findings of this preliminary feasibility study. In conclusion, the results of the preliminary feasibility study strongly suggests that further steps be taken toward the formation of a conservancy district in the study area.

PERFORMANCE REPORT

NUMBER 6

Preliminary Feasibility Study for East Central Water Conservancy District

For Period: 10-21-70 to 11-24-70

PERFORMANCE REPORT - T.A.P. INCORPORATED

PROJECT: East Central Water Conservancy District

5-19-70 to 10-20-70
10-21-70 to 11-24-70

TASK	PERFORMANCE (Jan Fel Mar Apr May June July Aug Sept Oct Nov Dec)	Task Comp. 10-21-70 to 11-24-70	Task Comp. to Date	Task % of Project	% of Project Comp. 10-21-70 to 11-24-70	% of Project Comp. to Date
1. Resource Inventory (4 counties)		---	100.00%	3.95	---	3.95
2. Contact Agencies		---	100.00%	5.93	---	5.93
3. Soils & Mapping		---	100.00%	25.69	---	25.69
4. Alternative Engineering System		---	100.00%	2.77	---	2.77
5. Potential Water Uses		5.00	100.00%	7.91	0.40	7.91
6. Economic Impact		33.33	100.00%	7.91	2.63	7.91
7. Investment; Operation & Maint.		33.33	100.00%	7.91	2.63	7.91
8. Legal & Financial		25.00	100.00%	3.16	0.79	3.16
9. Establish W. C. Dist.-Final Report		37.50	87.50%	15.81	5.93	13.83
10. Meetings		---	60.00%	5.93	---	3.56
11. Administration & Supervision		15.15	96.97%	13.04	1.98	12.64
12.						

* Excludes basic Engineering of Alternative Water Systems.

% Total Project Completed 10-21-70 to 11-24-70 14.36

% Total Project Completed To Date 95.26